

ABSTRAK

INTEGRASI CITRA DIGITAL DAN TEKNOLOGI IOT PADA SISTEM *AQUAPONIC*

(2025 : 99 Halaman + 43 Gambar + 6 Tabel + Daftar Pustaka + Lampiran)

RIYO IRAWAN

062140342343

JURUSAN TEKNIK ELEKTRO

PROGRAM STUDI D-IV TEKNIK ELEKTRO

Penelitian ini mengusulkan integrasi teknologi citra digital dan Internet of Things (IoT) pada sistem aquaponik guna meningkatkan efektivitas pemantauan serta deteksi ukuran ikan secara otomatis. Sistem aquaponik yang digunakan menggabungkan budidaya ikan nila merah dan hidroponik dalam sirkulasi tertutup. Pemrosesan citra digital dilakukan dengan model deep learning berbasis YOLO, yaitu YOLOv5, YOLOv8, YOLOv11, serta model hybrid YOLOv8-Faster R-CNN. Hasil evaluasi menunjukkan bahwa masing-masing model memiliki keunggulan tersendiri: YOLOv5 unggul dalam recall, YOLOv11 terbaik dalam mAP50 dan F1-score, sementara model hybrid menawarkan keseimbangan performa meskipun memerlukan waktu pelatihan lebih lama. Teknologi IoT digunakan untuk memantau parameter lingkungan secara real-time yang terhubung ke cloud. Hasilnya menunjukkan bahwa sistem ini efektif untuk otomatisasi pemantauan dan deteksi ikan dalam budidaya aquaponik.

Kata kunci: Aquaponik, Citra Digital, IoT, YOLO, Faster R-CNN, Deep Learning, Deteksi Objek

ABSTRACT

INTEGRATION OF DIGITAL IMAGE AND IOT TECHNOLOGY IN AQUAPONIC SYSTEM

(2025 : 99 Pages + 43 Figures + 6 Tables + References + Appendices)

RIYO IRAWAN

062140342343

JURUSAN TEKNIK ELEKTRO

PROGRAM STUDI D-IV TEKNIK ELEKTRO

This study proposes the integration of digital image processing and Internet of Things (IoT) technology in an aquaponic system to enhance the effectiveness of real-time monitoring and automatic fish size detection. The aquaponic setup combines red tilapia aquaculture and hydroponics in a closed-loop system. Image processing is carried out using deep learning models based on the YOLO (You Only Look Once) architecture, including YOLOv5, YOLOv8, YOLOv11, and a hybrid model combining YOLOv8 with Faster R-CNN. Evaluation results indicate that each model offers unique advantages: YOLOv5 excels in recall, YOLOv11 achieves the highest mAP50 and F1-score, while the hybrid model provides balanced performance with longer training time. The IoT system monitors environmental parameters in real-time and is connected to the cloud for remote access. Overall, the integrated system proves effective for automating monitoring and fish detection in modern aquaponic operations.

Kata Kunci : *Aquaponics, Digital Image Processing, IoT, YOLO, Faster R-CNN, Deep Learning, Object Detection*